

AMENDMENTS

This listing of claims replaces all prior versions, and listings, of claims in the application:

In the Claims:

1. (Withdrawn) A semiconductor device comprising:

a base region of a first conducting type formed on a collector layer of a second conducting type;
a trench provided in the base region;
an emitter region of the second conducting type formed adjacent to a bottom portion of the trench;
a sidewall provided on an inside wall of the trench; and
an electrode in contact with the whole surface of the base region excluding the trench.

2. (Withdrawn) A semiconductor device comprising:

a base region of a first conducting type formed on a semiconductor substrate which serves as a collector layer of a second conducting type;
a trench provided in the base region;
an emitter region of the second conducting type formed adjacent to a bottom portion of the trench;
a sidewall provided on an inside wall of the trench;
an emitter electrode filling the trench and in contact with the emitter region;
a base electrode layer in contact with the whole surface of the base region excluding the trench;
an insulating film covering the base electrode layer; and

a base electrode provided on the insulating film and in contact with the base electrode layer.

3. (Withdrawn) The semiconductor device according to claim 2, wherein the trench is shallower than the base region.

4. (Withdrawn) The semiconductor device according to claim 2, wherein the trench has a shape so that the inside wall has an slope so that an angle created by a line tangent to the slope and a surface of the semiconductor substrate becomes gradually smaller in a direction from the trench bottom portion to the semiconductor substrate surface.

5. (Withdrawn) The semiconductor device according to claim 2, wherein the base electrode layer is formed of polysilicon.

6. (Withdrawn) The semiconductor device according to claim 2, wherein the base electrode layer is formed of silicide.

7. (Withdrawn) The semiconductor device according to claim 2, wherein the base electrode layer is formed of a multi-layer film comprising polysilicon and silicide.

8. (Withdrawn) The semiconductor device according to claim 2, wherein the insulating film is formed of an oxide film or a multi-layer film comprising an oxide film and a nitride film.

9. (Currently Amended) A method for manufacturing a semiconductor device comprising:

~~forming a base region doping impurities of a first conducting type [[on]] into a surface of a collector layer of a second conducting type and thermally diffusing the impurities of the first conducting type to form a base region of the first conducting type in the surface of the collector layer;~~

forming a base electrode layer on a surface of the base region and forming an insulating film on a surface of the base electrode layer;

forming a trench, which does not reach the collector layer, [[in]] by etching the base region ~~by creating through~~ an opening created at part of the base electrode layer and the insulating film and forming a sidewall on an inside wall of the trench;

forming a polysilicon layer containing impurities for emitter diffusion inside the trench;

forming an emitter region by diffusing the impurities of the polysilicon layer; and

forming a through hole in the insulating film, forming a base electrode contacting the base electrode layer through the through hole and forming an emitter electrode contacting the polysilicon layer.

10. (Original) The method for manufacturing a semiconductor device of claim 9, wherein the trench is formed as a γ -shaped trench.

11. (Previously Presented) The method for manufacturing a semiconductor device according to claim 9, wherein the base electrode layer is made of polysilicon, silicide, or a multi-layer film comprising polysilicon and silicide.

12. (Previously Presented) The method for manufacturing a semiconductor device according to claim 10, wherein the base electrode layer is made of polysilicon, silicide, or a multi-layer film comprising polysilicon and silicide.

13. (Currently Amended) A method for manufacturing a semiconductor device comprising [[the]]:

preparing a collector layer of a first conducting type;

forming a base electrode layer made of polysilicon containing impurities of a second conducting type on a surface of the collector layer and forming an insulating film on a surface of the base electrode layer;

forming a trench [[in]] by etching the collector layer ~~by creating through~~ an opening created at part of the base electrode layer and the insulating film and doping impurities of the second conducting type ~~so that a doped region is formed around into~~ the trench and [[in]] the base electrode layer;

forming a sidewall on an inside wall of the trench;

forming a polysilicon layer containing impurities for emitter diffusion inside the trench; diffusing the impurities of the second conducting type ~~of the doped region~~ for forming a base region and, at the same time, diffusing the impurities of the polysilicon layer for forming an emitter region; and

forming a through hole in the insulating film, forming a base electrode contacting the base electrode layer through the through hole and forming an emitter electrode contacting the polysilicon layer.

14. (Original) The method for manufacturing a semiconductor device of claim 13, wherein the trench is formed as a γ -shaped trench.

15. (Previously Presented) The method for manufacturing a semiconductor device of claim 9, wherein the base electrode and the emitter electrode are formed in a same processing step.

16. (Previously Presented) The method for manufacturing a semiconductor device of claim 9, wherein the emitter region is formed by diffusing the impurities of the polysilicon layer so that the emitter region is formed within the base region.

17. (Previously Presented) The method for manufacturing a semiconductor device of claim 13, wherein the base electrode and the emitter electrode are formed in a same processing step.